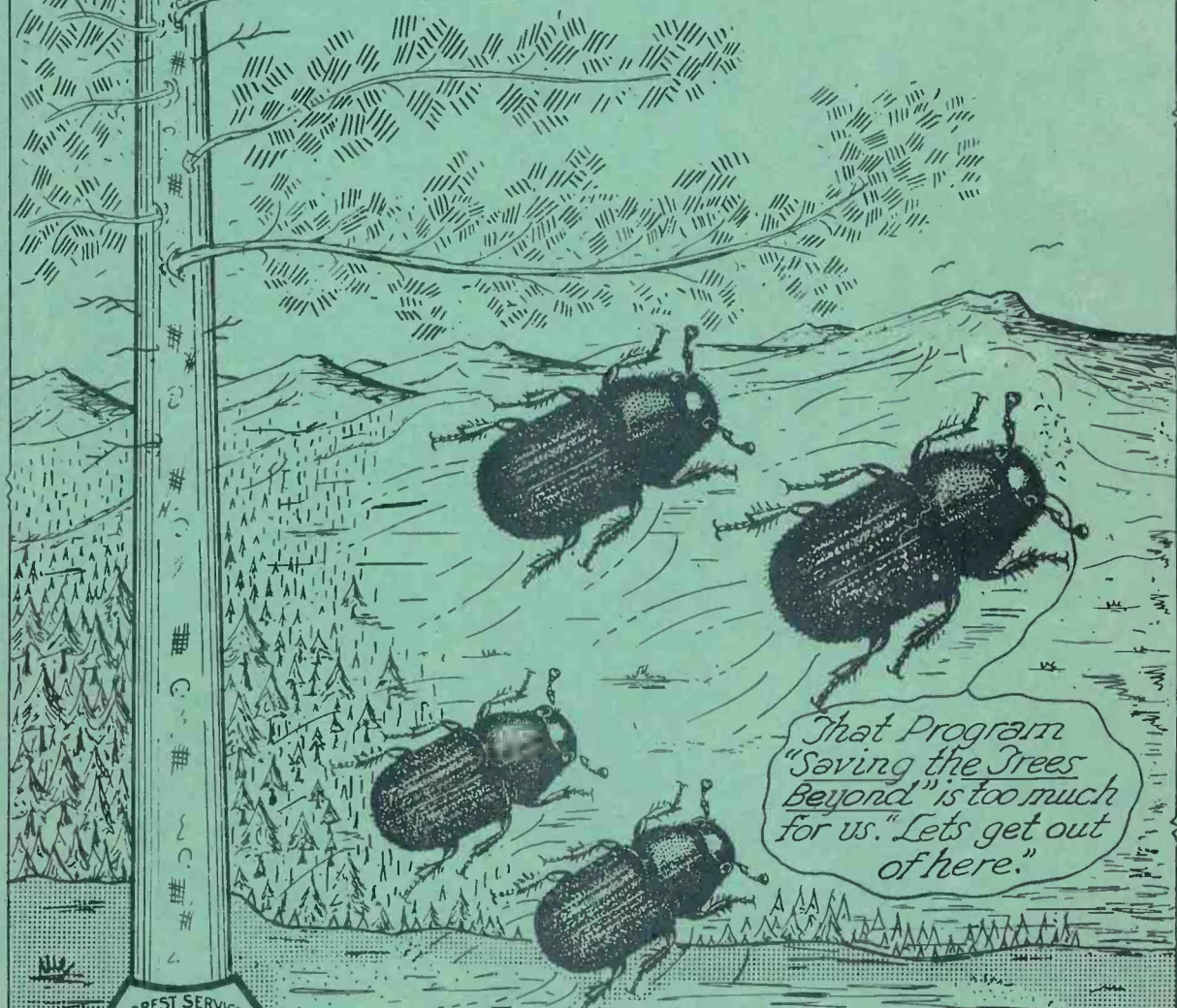
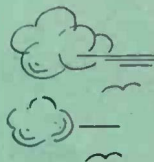


ENGELMANN SPRUCE
BARK BEETLE CONTROL PROJECT
COLORADO
1950-52



*That Program
"Saving the Trees
Beyond" is too much
for us. "Let's get out
of here."*



U.S. Department of Agriculture
FOREST SERVICE &
BUREAU OF ENTOMOLOGY &
PLANT QUARANTINE

FOREWORD

With the completion of the 1952 Engelmann spruce beetle control project, we have attained the major objectives in our program to save billions of board feet of timber and related values in the national forests of Colorado. The success of this program, which has been conducted during the past three years, now seems assured. Beetle populations in all epidemic areas have been reduced to endemic proportions and it is expected that natural enemies of the beetle will keep the infestation in check with the aid of some minor mop-up control measures.

Two agencies of the United States Department of Agriculture have participated in the control program: the Bureau of Entomology and Plant Quarantine and the Forest Service. The Bureau of Entomology and Plant Quarantine has conducted the surveys of the infestation, furnishing the necessary information for planning the control program, and has provided technical assistance in all phases of the control work. The Forest Service has provided the operating administration of the project.

A great deal of credit for the success of this program should go to the newspapers, radio stations, the State of Colorado, and individuals who gave support to the control work from the beginning. It is indeed gratifying to note the increased public concern over the saving of our priceless natural resources.

The State Employment Services of Colorado, New Mexico, and Arizona, the U. S. Indian Service, and the colleges of the country rendered an invaluable service in helping us with manpower recruitment. Special credit should go to Leigh Hubbard and George M. Fellshaw for their help in the recruiting of Indians.

This has truly been a service-wide project. Regular Forest Service personnel were detailed from all parts of the country to head up the organization. Each person who contributed his services can take pride in his part in the work. No less credit is due those who remained at home, for to them fell the additional burden of carrying on the regular activities. It is a credit to the Service that there was no appreciable decline in the standards of performance in the over-all job of national forest administration.

It has been a big job. We can all be justly proud of the fine record of accomplishment which has been attained.



DONALD E. CLARK
Regional Forester

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HISTORY OF THE INFESTATION

During the ten-year period from 1939 to 1949 it is estimated that one-fourth of the spruce timber in Colorado was killed by the Engelmann spruce beetle (Dendroctonus engelmanni Hopk.). This represents a loss of over four billion board feet of spruce. In addition to this spruce loss, there were many millions of board feet of lodgepole pine killed by the spruce beetle.

The Engelmann spruce beetle outbreak in Colorado started simultaneously on the White River, Grand Mesa, Gunnison, San Juan, and Uncompahgre National Forests as a result of "blow downs" occurring in June, 1939. High winds up to 60 miles per hour swept across the forests of the Western Slope causing extensive damage to the spruce timber stands. Engelmann spruce beetles already present in the stands endemically were attracted to the tangled, broken mass of fallen trees, produced broods that year and subsequent years which were protected by heavy blankets of snow from both woodpeckers and cold temperatures.

In 1942 the infestations were discovered in these remote blow-down areas but even at this early date the beetles had increased in numbers at a tremendous rate and were attacking standing spruce trees. Control methods were immediately discussed but were postponed because of World War II. Wherever possible salvage cuttings were made. These cuttings later proved to be a very effective method by which to halt the spread of the epidemic. Gradually the outbreak died down on the Grand Mesa, San Juan, Uncompahgre, and Gunnison National Forests; but prevailing southwesterly winds carried the outbreak across the White River National Forest and eventually to the Routt, Arapaho, and old Holy Cross Forests.

For several years the outbreak moved in a northeasterly direction but during the flight period of 1949 strong northwest winds pushed the beetles southeastward over the Colorado River into vast areas hitherto free of beetle attack. The flight across the wide Colorado River Valley took a heavy toll of the brood resulting in a relatively light attack in the newly infested areas. By 1951 control measures and natural factors had reduced the beetle population to the point where all new attacks were contained within the previous exterior boundaries of infestations.

FACTORS AFFECTING CONTROL OF THE OUTBREAK

The seriousness of the outbreak was recognized in the fall of 1942, and in 1943 the Forest Insect Laboratory at Fort Collins made an extensive appraisal of the situation. In 1944 this laboratory began studies of the life history and habits of the Engelmann spruce beetle and initiated research with the aim of developing a satisfactory and economical method of controlling the beetle by chemical means. By the end of 1945 the life history of the beetle had been determined; progress on control research was encouraging.

Beginning in 1944 annual surveys were conducted in the epidemic areas to determine the location and trend of the outbreak. It soon became apparent that the infestation was moving in a general northeasterly direction and dying out on the forests to the south and west. It was hoped that the infestation would die out in the lodgepole pine stands of the Gore Range and adjacent to North Park.

During the years between 1943 and 1949, the outbreak was so large as to be beyond control. It would have been impossible to get the necessary manpower, equipment, and supplies for a project of this magnitude.

The survey findings in 1949 revealed two significant developments: (1) a tremendous beetle flight had moved south across great open areas into vast continuous bodies of spruce hitherto free from beetle attack; (2) enormous numbers of beetles died while enroute across extensive sagebrush areas.

It was found that the outbreak had been reduced and was at its lowest level in years. The threat to the remaining green spruce forests, however, was increased by the extension of the outbreak front. Considering these developments, the Bureau of Entomology and Plant Quarantine and the Forest Service jointly recommended that immediate action be taken to protect the remaining spruce stands.

THE CONTROL PROGRAM

1949

With the decision to initiate control work on the Engelmann spruce beetle, it was decided to set up a pilot control project to obtain the operational information necessary to conduct a large project. This pilot-plant project was set up on Basalt Mountain on the



Insect killed Engelmann spruce in Coffee Pot area on south side of White River Plateau. This stand was under attack in 1947-1949.

White River National Forest in the fall of 1949 and operations were carried on for about a month.

Approximately 3000 trees were treated at a cost of \$5.30 per tree. This was somewhat higher than had been anticipated due to the fact that it was a hurry-up project of short duration. However, valuable information was obtained on organization, treating methods and an indication of costs. The project also demonstrated that successful chemical treatment could be accomplished on a project basis.

1950

During the fall of 1949, plans were made for a program of treating an estimated 651,000 trees and a request for a deficiency appropriation of \$2,885,000 was submitted by the Department of Agriculture to the Bureau of the Budget. Final appropriation of \$2,000,000 was made late in June of 1950.

The 1950 Control Project, although handicapped by a late start and insufficient funds, accomplished the major part of its planned objective which was to kill the beetle brood in 1949-attacked trees along the eastern and southeastern fronts of the infestation. When the 1950 project closed in October, a total of 784,082 beetle-infested trees had been treated.

The 1950 Control Project made a tremendous reduction in the beetle population which would have attacked in 1951. With an adequate project in 1951, the beetle brood would be further reduced.

A detailed report of the 1950 project entitled "Engelmann Spruce Bark Beetle Control Project, Colorado - 1950" was prepared at the end of the year.

1951

In the fall of 1950 over 2,800,000 gross acres of forest land on the Western Slope of Colorado were surveyed by the Bureau of Entomology and Plant Quarantine. This survey indicated the need for treating 1,643,000 trees in 1951 on 51 separate units. Based on this survey data, request was made for \$3,895,000 to finance the 1951 control program.

On February 1, 1951, the first real break in the form of control by natural factors occurred. Temperatures reached a record low of minus 56 degrees F. at Eagle and a minus 49 degrees F. at Kremmling. Earlier work by entomologists had determined that sustained temperatures of minus 30 degrees beneath the bark was lethal to the bark beetle. It was immediately suspected that some mortality could be expected and it was later proved that the mortality was very high in some areas.

After results of the winter mortality became known, it was apparent that a smaller program than was originally planned would be entomologically sound. When the first of August arrived and funds were still not available, new plans were made for a greatly reduced program. Entomologists were able to delete still further from the original control program because of mounting insect mortality.

An appropriation of \$1,000,000 was made available on August 20 and work started immediately. Actual treating was under way on August 27. Recruitment of labor was difficult because of the late start; a high rate of turn-over was experienced, especially as cold stormy weather arrived in early October. However, 199,502 trees were treated between August 27 and October 20 on which date all camps were closed due to heavy snowfall.

Throughout the project, the Forest Service and the Bureau of Entomology and Plant Quarantine were continually seeking ways of speeding up the treating and reducing the costs. One of the methods used in 1951 was the trap-tree program. From tests made in 1949 and previous observation on timber sales, it had been determined that many more beetles were attracted to green down timber than to standing timber. During 1951, 2,722 trap trees were felled of which 1,277 were felled by timber sale operators at no cost to the Government. The felled trees were to be removed from the sale area following the 1952 beetle flight. Those trap trees located in inaccessible locations would be treated with insecticide.

Also in 1951, tests were made with ethylene dibromide at a ratio of one part of an emulsifiable concentrate to four parts water. Because only one gallon of this chemical need be transported to treating areas where water is available, considerable savings in transportation and storage costs would result.

Both 1950 and 1951 attacked trees were chemically treated in all areas where control work was done during the 1951 season. It was hoped that the beetle population would thus be reduced to endemic proportions which would forego future treatment.

A complete report of the 1951 project entitled "Engelmann Spruce Bark Beetle Control Project, Colorado - 1951" was prepared at the end of the season.

1952

As a result of the "deep freeze" and the increased effect of woodpecker and parasite work combined with effective treating, the beetle population was greatly reduced during the 1951 season. The survey, conducted by the Bureau of Entomology and Plant Quarantine, indicated the probable need for treating 400,000 trees on 18 separate units in 1952 as compared with the estimated 1951 program of 1,643,000 trees needing treatment on 51 work units.

On the basis of the above estimated job, and using costs from previous years' projects, a request was made for \$1,325,000 to conduct the 1952 program. It was felt by foresters and entomologists associated with the project that a program of this size would deliver the "back-breaking" blow to the epidemic.

The 1952 project got off to a good start. With a balance of about \$200,000 on hand from the 1951 project, and assurance that the requested \$1,325,000 would be available in early July, it was possible to get the project under way as soon as weather permitted. As a result, advance planning, scouting, and training were excellent. The employment situation was good in that a great many young men were just getting out of school and were interested in a summer's work in the mountains.

It became evident early in June that woodpecker work during the winter had been very heavy. A reduced beetle population was causing an increased woodpecker population to do more effective work on the beetle infested trees. Areas on which treating had been planned became unnecessary to treat due to heavy woodpecker work and subsequent drying out of the bark which killed remaining larvae.

By July first, foresters in charge of the control work were convinced that plans for treating 400,000 trees could be greatly reduced. This was later substantiated by field surveys of the Bureau of Entomology and Plant Quarantine. Some areas were heavily treated for 1950 attacked trees with the result that the 1952 flight in those areas was practically eliminated. The 1952 beetle flight, in general, was much lighter than anticipated with correspondingly weaker attacks than in previous years.

As the season progressed, conditions became more and more favorable for bringing the outbreak under control. Entomologists, working closely with the Forest Service, furnished information currently on treatable and non-treatable areas. Rapidly changing conditions resulted in many changes in plans.

About the first of August, ethylene dibromide was received and was put into use on both Kremmling and Eagle areas on a trial basis. It proved to be quite satisfactory in all respects, and, because it was possible to use this chemical during rainy weather, progress in treating was increased over previous years.

During August, entomologists and Forest Service scouts noted a marked increase in the effectiveness of parasite work. By the middle of the month it became highly questionable as to whether treating should be continued. The beetle population had evidently been so greatly reduced that parasites and woodpeckers were concentrating on the remaining infested trees. At a conference of forest officials and entomologists, following a field examination, it was decided that the natural enemies of the beetle had the situation well in hand and that treating operations should be terminated.

Treating was completed on the Eagle area on August 16 and on the Kremmling area on August 22. By the end of the month camps were dismantled and equipment stored. Shortly after the first of September area offices were closed.

A total of 232,757 trees were treated with insecticide during the 1952 season. In addition, 2,305 trap trees were cut on the Kremmling area, 1,100 of which were cut by a timber operator and will be removed from the area. The 1,205 trap trees felled by project crews were treated in the fall of 1952. Considerable work has been done towards cleanup and drainage of roads to be retained on the permanent road system. Also, a great deal of work has been done on seeding and drainage of those roads which will be closed. A considerable portion of the road system will be retained temporarily to facilitate surveys by the Bureau of Entomology and Plant Quarantine in 1953 and for mop-up operations which may be necessary.

The Colorado Spruce Beetle Project is being brought to a close with a feeling of great satisfaction for a job well done and a belief that minor control work and natural enemies of the beetle will complete the major portion of the remaining work necessary to "Save the Trees Beyond."



Bureau of Entomology and Plant Quarantine men
McCambridge and Finley preparing estimates of
intensity and placement of insect attack areas.

SUMMARY OF ACCOMPLISHMENTS
1949 - 1952
Colorado Engelmann Spruce Beetle Control Project

Total funds available fiscal years 1950-1953.....	\$ 4,265,496
Total trees treated	1,219,344
Total trap trees cut	5,027
Acres on which treating was done .	33,300 <u>1/</u>
Total gallons insecticide used ...	1,691,296
Average gallons insecticide used per tree	1.4
Total camp man days	82,140
Average number trees treated per camp man-day	14.8
Total expenditures to 12/31/52	\$ <u>3,327,946</u>
Balance 1/1/53	\$ 937,550
Cost per tree	\$ 2.73
Total miles roads:	
Construction	421 miles
Betterment	125 miles

1/ This acreage treated all three years.

ACCOMPLISHMENTS BY YEARS
Colorado Engelmann Spruce Beetle Control Project
(San Juan and Rio Grande Forest Engelmann Spruce projects were financed from
these funds. These figures are included in the total but shown separately
in parentheses)

	<u>1949</u>	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>Total</u>
Total trees treated	3,003	784,082	199,502	232,757	1,219,344
San Juan and Rio Grande	-	-	(500)	(4,898)	(5,398)
Total trap trees cut	-	-	2,722	2,305	5,027
Acres on which treating was done	140	33,300	6,977	11,582	33,300*
San Juan and Rio Grande	-	-	(154)	(1,500)	(1,654)
Total gallons insecticide used	7,308	1,003,253	378,347	302,388	1,691,296
San Juan and Rio Grande	-	-	(1,000)	(10,796)	(11,796)
Average gal. insecticide used per tree	2.43	1.28	1.9	1.3	1.4
San Juan and Rio Grande	-	-	(2.0)	(2.0)	(2.0)
Total camp man-days	202	52,198	15,848	13,892	82,140
San Juan and Rio Grande	-	-	(31)	(304)	(335)
Average trees treated per camp man-day	15	15.02	12.6	16.7	14.8
Grand Total expenditures - calendar year	\$ 16,000	\$1,962,052	\$660,663	\$689,231	\$3,327,946
San Juan and Rio Grande	-	-	(1,957)	(14,776)	(16,733)
Total cost per tree - calendar year	\$5.30	\$2.50	\$3.31	\$2.96	\$2.73
Total miles roads					
New construction	2.5	334	53	31.3	420.8
Betterment	-	54	-	70.5	124.5
Maintenance	-	-	236	338.0	574.0

* Maximum figure since most treating work during 3-year period was confined to the same areas.



Filling tank truck with ortho mix at Denver mixing plant. Furnishing of fuel oil and the mixing with ortho was contracted in Denver.

SUMMARY OF COSTS
Colorado Engelmann Spruce Beetle Control Project
1949 - 1952

	<u>Account</u>	<u>Total Cost</u>	<u>Cost per tree</u>	<u>Percent of Total</u>
1	Director's Office, including warehouse and maps	\$ 276,756	.23	8.
4	Area Offices	149,993	.12	5.
5	Ortho Depots and Warehouses	149,806	.12	5.
6	Insecticides	550,242	.45	16.
7	Camp Operation - Treating	\$1,406,128	1.15	42.
8	Road Construction and Main- tenance	375,112	.31	11.
9	Equipment Operation, Repair and Replacement	<u>419,909</u>	<u>.35</u>	<u>13.</u>
	TOTALS	\$3,327,946	2.73	100.

1952 SURVEYS

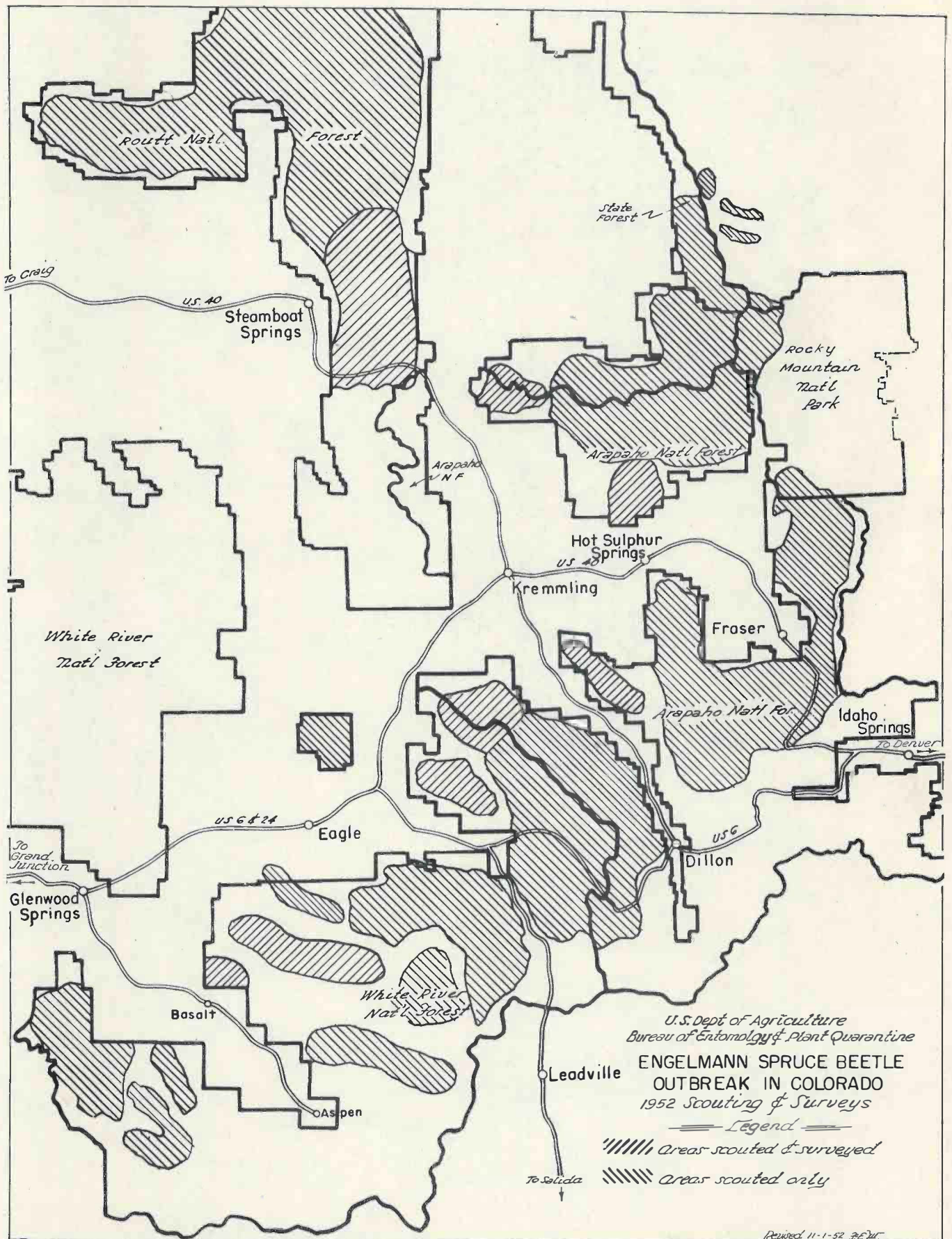
The field survey of 1952 attacked spruce began in mid-July and terminated September 12; about 2.4 million gross acres of land were surveyed. This survey was carried on in two phases, scouting and surveying. Scouting was done in areas where epidemics were not known to exist, the objective being to locate all epidemics which do exist. Surveying was done in areas where epidemics were known to have existed in 1951, or where scouting parties had newly located epidemics. The objectives of the survey were to estimate the average number of infested trees per acre for any designated area, determine accurately the size of each infested area, compute a reliable estimate of the total number of trees to be treated within limits of economical feasibility, and map the concentrations of infested trees.

As a result of control work in 1952 and during previous years, together with the buildup of natural control factors, the outbreak is at an endemic level over practically all of the area. The work during the coming year will be very important since it will be a cleanup of the small scattered groups which could develop to epidemic levels once more. The increase in woodpecker and parasite populations is a distinct added assurance that the outbreak will be maintained at an endemic level.

The Kremmling control area contains no standing trees which need treating in 1953. Trap trees may be needed in the fall of 1953 to absorb the 1954 flight from scattered 1952 attacks.

The Eagle control area contains no 1952 attacked standing trees needing treatment in 1953. On Red and White Mountains and on Red Table Mountain many down trees which will absorb 1953 beetle flights will need to be treated in 1953. Trap trees may be needed on Red Table Mountain in the fall of 1953 to absorb the 1954 flight.

A control program in 1953 must be prepared to treat trap trees already down, cut additional trap trees, and treat possibly 25,000 standing trees which might be infested by the 1953 flight from the scattered untreated 1951 attacked trees. Actually, 25,000 is much higher than expected, but this maximum, based on available figures, must be anticipated.



Revised 11-1-52 R.E.W.

A P P E N D I X

ACCOMPLISHMENTS
of
COLORADO ENGELMANN SPRUCE BEETLE CONTROL PROJECT
1952

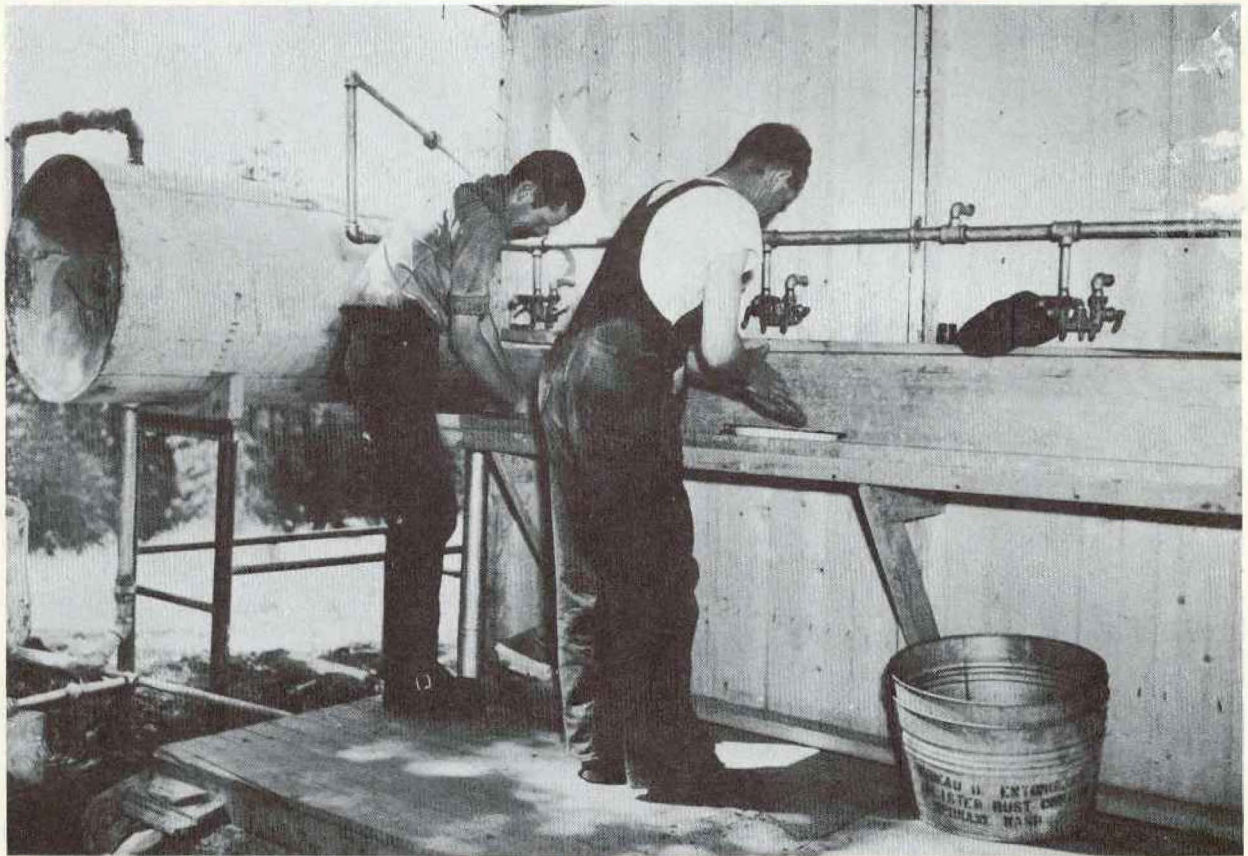
Total trees treated	232,757*
Total trap trees cut	2,305
Acres on which treating was done	11,582*
Total gallons insecticide used	302,388*
Average gallons insecticide used per tree	1.3*
Total camp man-days	13,892*
Average trees treated per camp man-day	16.7
Total expenditures	689,231*
Cost per tree	2.96*
Total miles roads:	
New construction	31.3
Betterment	70.5
Maintenance	338.0**

* Includes data for small projects on the San Juan and Rio Grande National Forests.

** Includes extra maintenance at end of season.

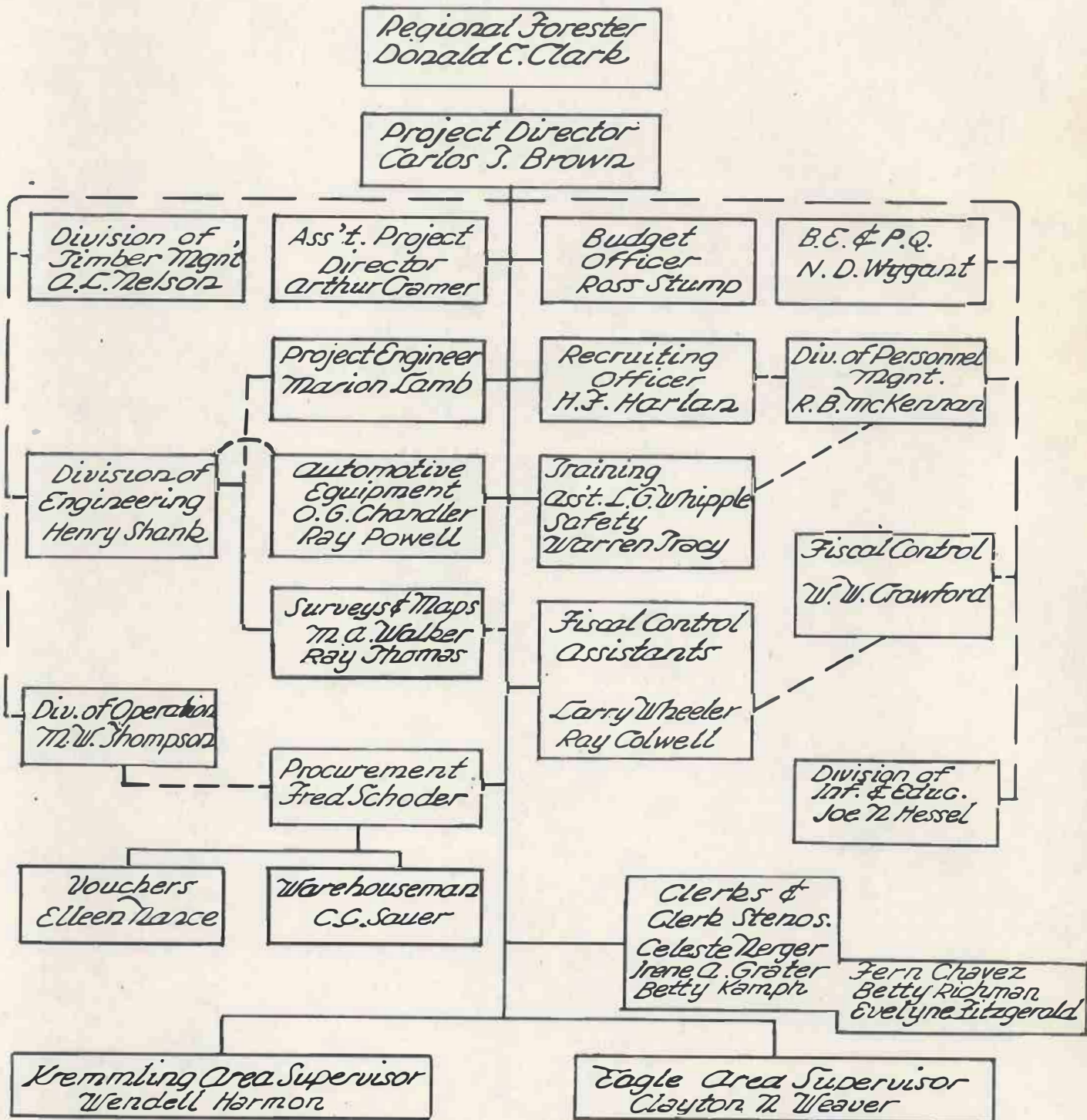
SUMMARY OF COSTS - 1952
Colorado Engelmann Spruce Beetle Control Project

<u>Account</u>	<u>Total Costs</u>	<u>Cost Per Tree</u>	<u>Percent of Total</u>
1 Director's Office, including warehouse and maps	\$ 94,284	\$.40	14.
4 Area Offices	30,562	.13	4.
5 Ortho Depots and Warehouse	42,347	.18	6.
6 Insecticides	99,531	.43	14.
7 Camp operation - Treating	268,694	1.15	39.
8 Road Construction and Maintenance	66,580	.30	10.
9 Equipment Operation, Repair and Replacement	<u>87,233</u>	<u>.37</u>	<u>13.</u>
TOTALS	\$689,231	\$2.96	100.



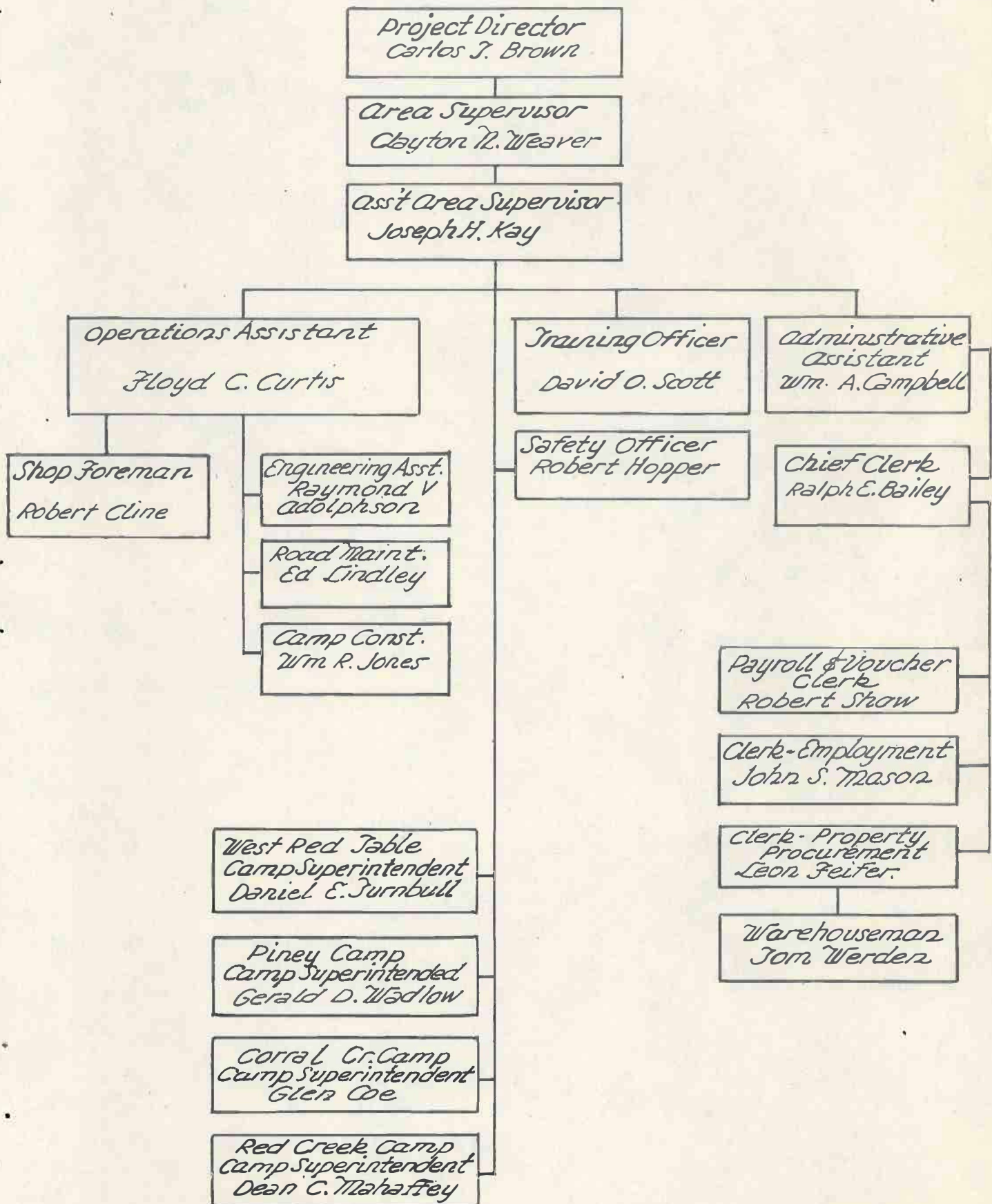
The bath house in use. Washing facilities were provided on either side with shower facilities inside.

DIRECTOR'S OFFICE ORGANIZATION CHART



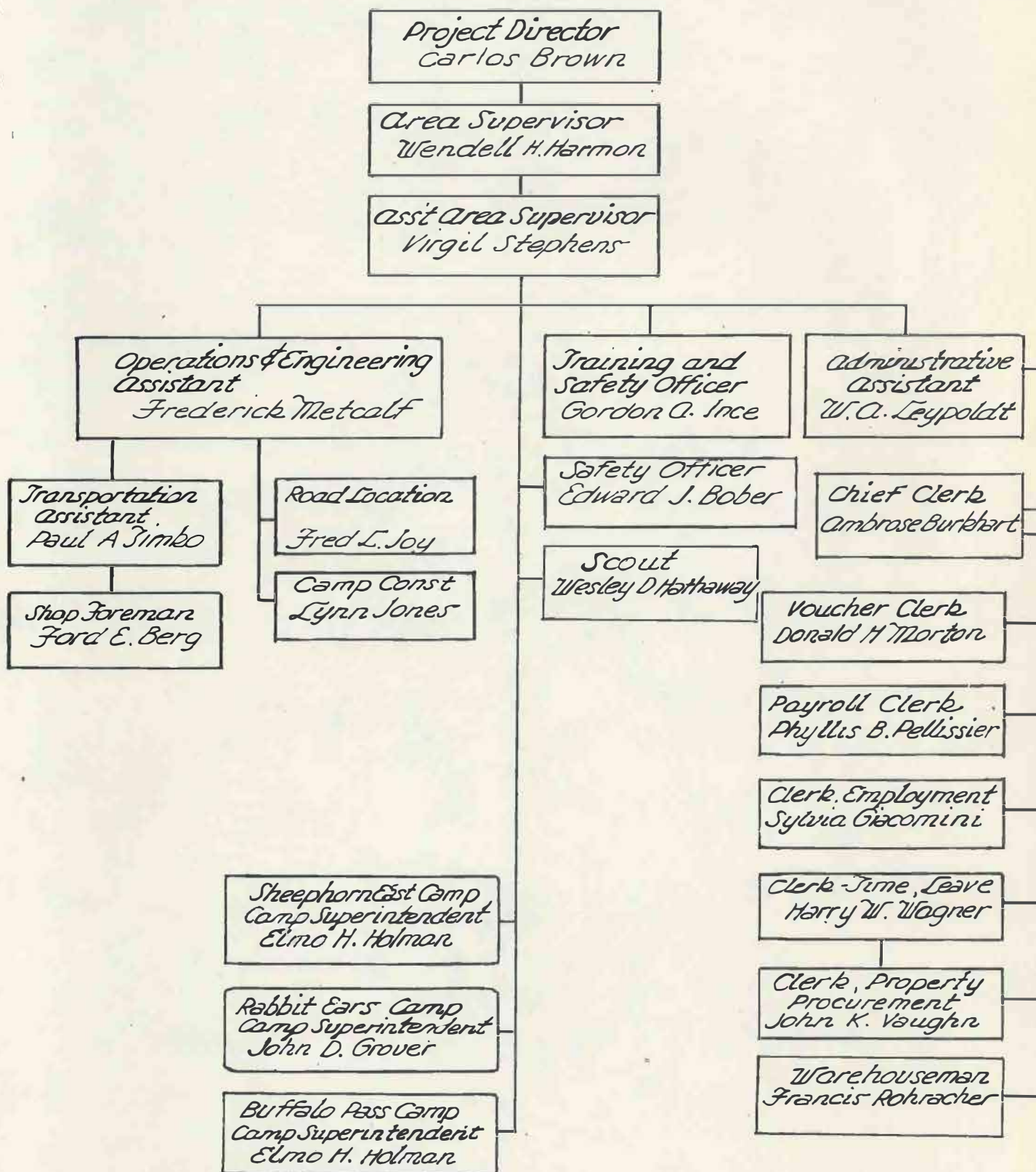
EAGLE AREA HEADQUARTERS

ORGANIZATION CHART



KREMMLING AREA HEADQUARTERS

ORGANIZATION CHART





The seven-man treating crew. One strawboss and two complete treating crews consisting of one nozzleman, one pumpman, and one goop carrier in each.

PERSONNEL ROSTER - INSECT CONTROL PROJECT - 1952

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

N. D. Wygant, Entomologist in Charge, Fort Collins, Colorado
Field Laboratory
C. L. Massey, Entomologist, Research on Biology
R. H. Nagel, Entomologist, Research on Insecticides and Trap Logs
B. H. Wilford, Entomologist, Project
F. B. Knight, Entomologist, Kremmling Area
W. F. McCambridge, Entomologist, Eagle Area (now at Portland, Oregon
Field Laboratory)
C. J. Hay, Entomologist, Kremmling Area Survey Assistant (now
at Gulfport, Mississippi Field Laboratory)
F. T. Hutchison, Entomologist, Eagle Area Survey Assistant (Forest
Entomologist in office of Colorado State Forester)

FOREST SERVICE

<u>Region and Name</u>	<u>Position</u>
<u>Region 1</u>	
Bennett, John E.	Spotter (Kremmling)
Curtis, Floyd C.	Operations Assistant (Eagle)
DeLaMartre, Robert R.	Treating Foreman (Kremmling)
Groben, Millard M.	Treating Foreman (Eagle)
Hayes, Lowell S.	Spotter (Eagle)
Inman, Earl	Treating Foreman (Eagle)
Metcalf, Frederick	Operations & Engineering Asst. (Kremmling)
Piehl, Willard D.	Spotter (Kremmling)
<u>Region 2</u>	
Adolphson, Raymond V.	Engineering Assistant (Eagle)
Anderson, C. A.	Asst. Project Director (Regional Off.)
Bert, Ford E.	Shop Foreman (Kremmling)
Brown, C. T.	Project Director (Regional Office)
Burkhart, Ambrose	Chief Clerk (Kremmling)
Campbell, William A.	Administrative Asst. (Eagle)
Chandler, O. G.	Equipment Inspector (RO)
Chavez, Fern	Bookkeeper (Regional Office)
Cline, Robert W.	Shop Foreman (Eagle)
Coe, Glen	Camp Superintendent (Eagle)
Colwell, Raymond G.	Auditor (Regional Office)
Cramer, Arthur	Asst. Project Director (Regional Off.)

Feifer, Leon	Property and Procurement Clerk (Eagle)
Fields, Charles	Messenger (Regional Office)
Giacomini, Sylvia	Employment Clerk (Kremmling)
Grater, Irene A.	Employment Clerk (Regional Office)
Grover, John D.	Camp Superintendent (Kremmling)
Gulliford, William R.	Mechanic Helper (Kremmling)
Harlan, Howard F.	Recruiting Officer
Harmon, Wendell H.	Area Supervisor (Kremmling)
Hathaway, Wesley D.	Scout (Kremmling)
Heeren, George W.	Mechanic Helper (Kremmling)
Hopper, Robert	Safety Officer (Eagle)
Ince, Gordon A.	Training Officer (Kremmling)
Johnson, Ray E.	Chief Spotter (Kremmling)
Johas, William R.	Camp Construction (Eagle)
Jones, Lynn	Camp Construction (Kremmling)
Kamph, Betty	Clerk-Stenographer (Regional Office)
Kay, Joseph H.	Asst. Area Supervisor (Eagle)
Lamb, Marion	Engineering Asst. (Regional Office)
Leypoldt, Waldron A.	Administrative Asst. (Kremmling)
Lindley, Ed	Road Maintenance (Eagle)
Mahaffey, Dean	Camp Superintendent (Eagle)
Marsh, Darlene	Clerk-Stenographer (Regional Office)
Miller, Phillip S.	Spotter (Kremmling)
Nance, Ellene M.	Procurement & Voucher Clerk (RO)
Nerger, Celeste T.	Clerk-Stenographer (Regional Office)
Plourde, William L.	Chief Treating Foreman (Eagle)
Powell, Raphael H.	ES Clerk (Regional Office)
Rohracher, Francis	Warehouseman (Kremmling)
Sauer, Charles C.	Chief Warehouseman (Regional Office)
Schoder, Fred	Purchasing Officer (Regional Office)
Sell, Jacob	Mechanic Helper (Eagle)
Smith, Foster	Mechanic Helper (Eagle)
Stillman, Richard M.	Assistant Camp Superintendent (Kremmling)
Strickland, Ralph	Mechanic Helper (Eagle)
Thomas, Raymond G.	Draftsman (Regional Office)
Tracy, Warren M.	Safety Officer (Regional Office)
Turnbull, Daniel E.	Camp Superintendent (Eagle)
Underhill, Verle	Mechanic Helper (Eagle)
Wadlow, Gerald D.	Camp Superintendent (Eagle)
Wagner, Harry W.	Clerk (Kremmling)
Weaver, Clayton N.	Area Supervisor (Eagle)
Werden, Tom	Supply Assistant (Eagle)
Wheeler, L. G.	Fiscal Asst. (Regional Office)
Whipple, L. G.	Training Officer (Regional Office)
Whitson, James W.	Mechanic Helper (Kremmling)
Williams, Ellis	Mechanic Helper (Eagle)

Region 3

Hall, Warren S.	Treating Foreman (Eagle)
Scott, David D.	Training & Planning Asst. (Eagle)
Weil, Edwin H. Jr.	Spotter (Eagle)
Welch, George D.	Spotter (Eagle)

Region 4

Cox, Hallie L.	Treating Foreman (Kremmling)
Hall, Dwight H.	Voucher Clerk (Kremmling)
Holman, Elmo H.	Camp Superintendent (Kremmling)
Horton, Lowell E.	Spotter (Eagle)
Moffett, Phillip S.	Spotter (Kremmling)
Morton, Donald H.	Voucher Clerk (Kremmling)

Region 5

Deemer, Robert D.	Assistant Camp Superintendent (Eagle)
Hopkins, Harry S.	Spotter (Kremmling)
Lara, Frank W.	Spotter (Eagle)
Laurent, Thomas H.	Treating Foreman (Kremmling)
Maloney, Ralph C.	Spotter (Eagle)
Storms, Glen	Spotter (Kremmling)

Region 6

Bailey, Ralph E.	Chief Clerk (Eagle)
Breitsprecher, Arthur A.	Spotter (Eagle)
Pierovich, John A.	Spotter (Kremmling)

Region 7

Shaw, Robert	Payroll & Voucher Clerk (Eagle)
Stump, Ross L.	Budget Officer (Regional Office)

Region 8

Carson, Benjamin F.	Chief Treating Foreman (Eagle)
Joy, Fred L.	Road Locator (Kremmling)
Leeper, Forrest D.	Spotter (Kremmling)
Maple, William R.	Spotter (Kremmling)
Schoenlank, Klaus	Spotter (Eagle)
Timko, Paul A., Jr.	Transportation Asst (Kremmling)
Yates, Leslie P.	Spotter (Kremmling)

Region 9

Bober, Edward J.	Safety Officer (Kremmling)
Fitzgerald, Evelyne	Clerk-Stenographer (Regional Office)
Hartwick, Robert A.	Treating Foreman (Eagle)
Jalosky, William R.	Spotter (Kremmling)
Jones, Thomas R.	Treating Foreman (Kremmling)
Mason, John S.	Clerk (Eagle)
Pellissier, Phyllis B.	Payroll Clerk, (Kremmling)
Richman, Betty	Clerk-Stenographer (Regional Office)
Schirck, Robert A.	Spotter (Kremmling)
Semmens, George N.	Chief Treating Foreman (Eagle)
Stephens, Virgil	Asst. Area Supervisor (Kremmling)

Central Experiment Station

Vaughn, John K.	Property & Procurement Clerk (Kremmling)
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A 4-man crew
1 spotter - strawboss
1 nozzleman
1 pumpman
1 goop carrier

CAMP ORGANIZATION - 1952

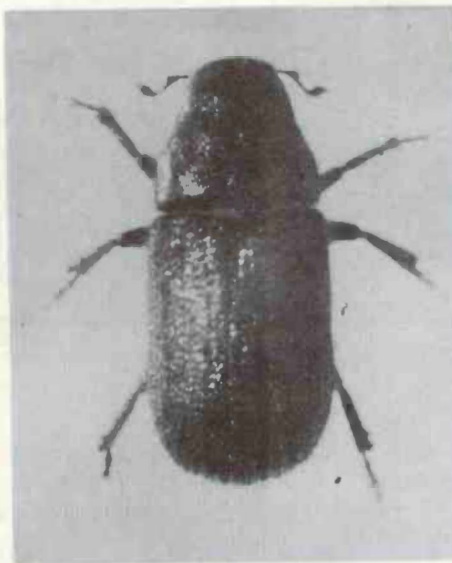
<u>Position</u>		<u>Distribution Per Camp</u>				
<u>Field</u>		<u>100-Man</u>	<u>75-Man</u>	<u>50-Man</u>	<u>25-Man</u>	<u>10-Man</u>
Superintendent		1	1	1	1	
Chief Spotter		1	1	1	1	
BE&PQ Technician*		4	4	3	2	
Treating Foremen		2	2	1		1
Spotters		12	8	4	2	1
Stringlayer		2	1	1		
Nozzlemen (Strawboss)		24	16	12	5	2
Pumpmen		24	16	12	5	2
Goop Carriers		24	16	12	5	2
Goop Truckers		4	2	2)		
Packers (Stock)		2	2	1)	1	1
<u>Total in Field</u>		<u>100</u>	<u>69</u>	<u>50</u>	<u>22</u>	<u>9</u>
<u>Office and Mess</u>						
Compiler		1	1	1	1	-
Cook*		2	2	1	1	1
Flunkies*		4	3	2	1	-
Bullcook		1	1	1	-	-
Total non-Field		8	7	5	3	1
Grand Total		108	76	55	25	10

* Not Forest Service Employees

LIFE HISTORY OF THE ENGELMANN SPRUCE BEETLE

Attacking Adults

Soon after snow melts in the spring, mature adults emerge from under the bark of trees where they developed and that they killed. They fly short distances to nearby green trees or farther when no local ones are available, in which to build their egg galleries. Several thousand beetles attack a single tree in a day or two; trees are soon overcome by the mass attack. Females followed by males construct a vertical gallery in

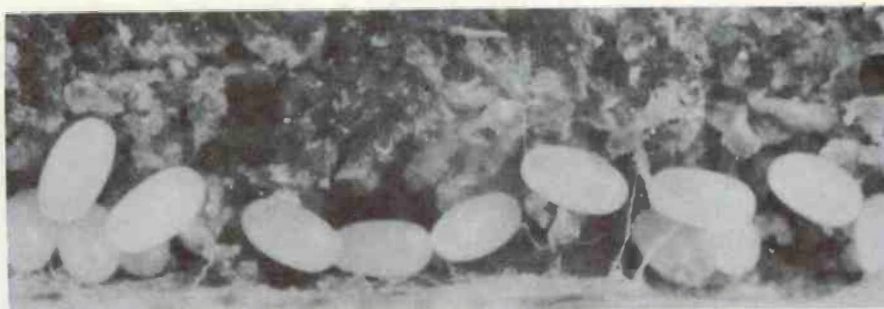


the living inner bark about 7 inches long; in it she lays about 140 eggs. The period of attack extends from about June 21-August 1. Each pair of insects builds one gallery per season. During August and September these parent adults come out of their galleries and congregate under the bark at the base of the tree. Those with sufficient vigor merge again next spring to attack new trees and lay an additional batch of eggs.

Adult - 10 X

Egg Stage

Eggs are laid during July and early August. They hatch in

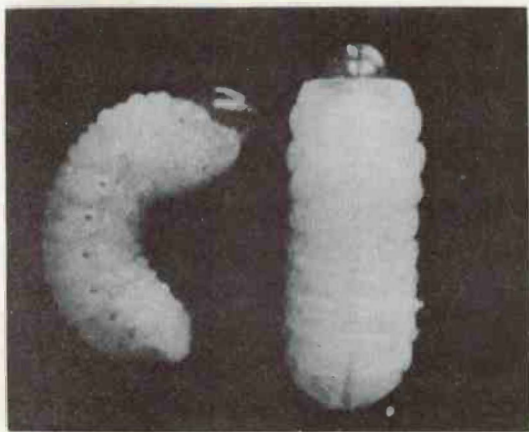


about 14 days, are pearly white and barely visible to the naked eye.

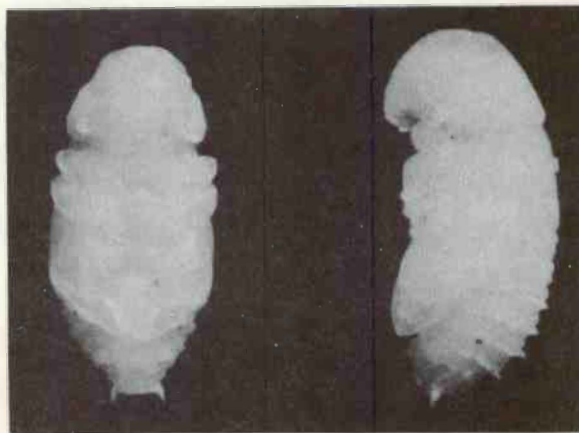
Eggs - 30 X

Larval Stage

Pupal Stage



Larvae - 8 X



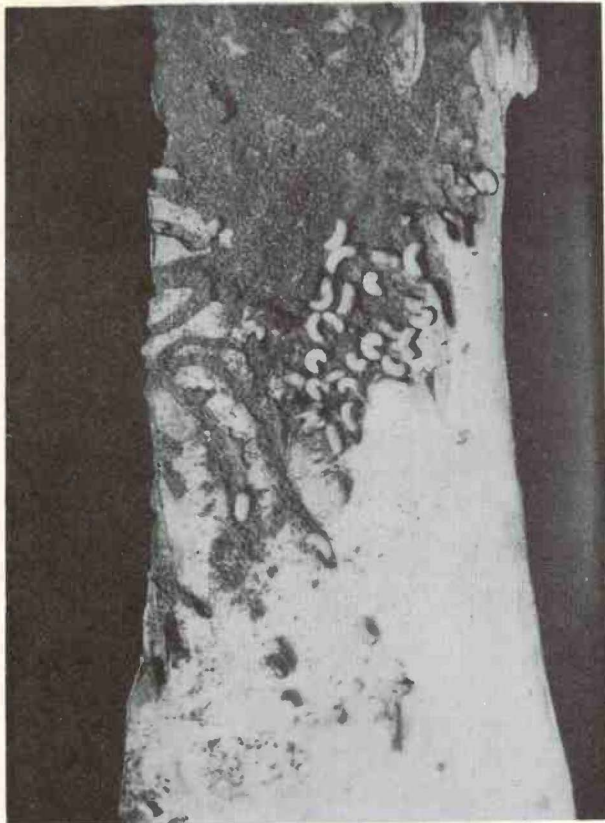
Pupae - 8 X

in a mass on the living in-
 + the side of the egg gallery
 uming it as they go. When about 1/3
 grown, usu. about the last of August
 and early September, they make separate
 galleries throughout the
 1 feeding stops
 s. The larvae
 bark through-
 resumed in
 ng. The larvae
 e in July when
 nich to pupate..

The pupal stage is a transformation per-
 iod from the larval to the adult stage.
 No feeding is done during this stage -
 largely occurring during late July and
 early August. The pupal stage lasts a-
 bout two weeks.

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Adults, first cream-colored, gradually change to a reddish-black stage o-
 ver a period of about two weeks. During this time, they feed on the inner
 bark. In late August and all of September, most of these newly-formed beet-
 es emerge from the bark of the upper stem of the tree to congregate beneath
 the bark at the base of the tree. The following spring they are mature and
 ready to attack new trees. The life cycle is completed in two years: i.e.,
 progeny of the beetles from the 1949-infested trees will be mature and read-
 y to attack new trees in June and July of 1951.



1/3 GROWN LARVAE FEEDING
 IN INNER BARK - 2 X

BARK REMOVED
 TO SHOW WORK

BUREAU OF
Entomology and Plant Quarantine
RECEIVED
APR 27 1953
Forest Insect Laboratory
BERKELEY, CALIF.